

An Approach of Automated Electronic Voting Management System for Bangladesh Using Biometric Fingerprint

M. Mesbahuddin Sarker¹, Md. Ariful Islam Shah¹, Tajim Md. Niamat Ullah Akhund¹, Md. Sharif Uddin²

¹Institute of Information Technology Institute, Jahangirnagar University, Savar, Dhaka.

²Dept. of Mathematics Jahangirnagar University, Savar, Dhaka.

Abstract— The existing system of election is running manually and the piloted electronic voting using electronic voting machine (EVM) has many limitations in its mechanism. In this paper we have proposed an automated biometric electronic voting system, where a four layered network system has been used for sending the votes from client to the main database, and there exist three application servers and a client. That means, the proposed systems starts with automated registration system that would provide the secured database of the voters' information, and voter details will be stored against their finger prints in the main database. Finally, at the end of the day, casted votes will be counted automatically which would take lesser time than the manual system and the result would be accurate, faster and reliable, and thus minimize the corruption.

Keywords— Electronic Voting, Biometric, EVM, SEIR.

I. INTRODUCTION

A biometric system is a technological system that uses information about a person (or other biological organism) to identify that person. Biometric systems rely on specific data about unique biological traits in order to work effectively. In general, biometrics is any use of biological data in technology. Biometric methods provide identification by using specifications such as fingerprints, face, hand shape, iris, retina, voice track and signature. These specifications vary from person to person. Biometric solutions are generally client/server solutions, giving system administrators the ability to audit usage, manage security levels, and remove unauthorized users

[Adem et. al, 2011]. In this study, biometric election system is aimed instead of traditional election systems. By developing the deficiencies of the present system, biometric based election system has been developed and gives the details of requirements, design and implementation of a generic and secure electronic voting system where voters can cast their votes any-time, anywhere and mainly to cast a vote to that person to whom voter want to cast a vote using a number of electronic devices.

The system that exists currently in Bangladesh is totally paper based except very few centers consider EVM. This EVM is a simple electronic device used to record votes in place of ballot papers and boxes which were used earlier in conventional voting system. It is a simple machine that can be operated easily by both the polling personnel and the voters. Being a standalone machine without any network connectivity, nobody can interfere with its programming and manipulate the result. It has mainly two units: Control unit and Ballot unit. The Control Unit is the main unit which stores all data and controls the functioning of EVM. The program which controls the functioning of the control unit is burnt into a microchip on a “one time programmable basis” [Sarker, 2013]. Once burnt it cannot be read, copied out or altered. The EVMs use dynamic coding to enhance security of data transmitted from ballot unit to control unit. The new EVMs have also real time clock and date-time stamping facility which enables them to record the exact time and date whenever a key is pressed. The existing election system in Bangladesh is pictured below:

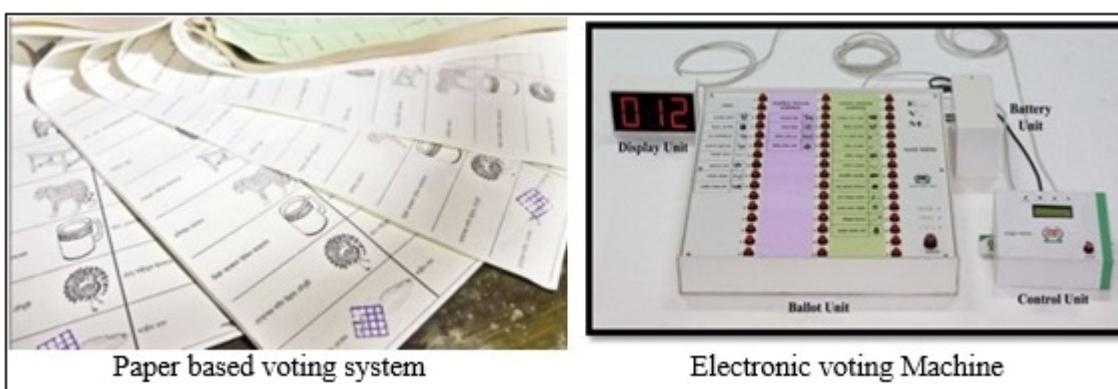


Fig.1: Existing election system in Bangladesh

II. PURPOSE OF THE RESEARCH

A close election in 1998 in the Australian Capital Territory (ACT) found numerous problems in the state's hand-counting system, when two candidates were separated by only three or four votes [Thomos, 2004]. After recounting, officials discovered that out of 80,000 ballots, they had made about 100 mistakes. Ultimately, the ACT Electoral Commission adopted a new system known as eVACS, or Electronic Voting and Counting System. The system was created (by a company called Software Improvements) to run on Linux, which is a widely used, freely available open-source operating system [AEC's, 2007].

Recently, over 100 million mobile phone SIMs have been re-registered with the biometric details of subscribers¹. A Bangladeshi Higher Court has declared that ongoing biometric SIM registrations using fingerprints is legal². The Bangladesh government has assured mobile phone users that their privacy would not be in jeopardy after they undergo biometric registration of their SIM cards and if there is any misuse of their personal data, carriers could be fined up to Tk. 300 crore (\$38.3M USD). "The cabinet has assured that there is no scope for misuse of the fingerprints of the subscribers and they need not be worried to this end"³.

The government decided to undertake voter registration along with their photographs, finger print and signature. The Bangladesh army commenced the creation of suitable people identification system to give the voter registration process a head start. International and local firms, academic institutions offered solutions. On invitation Dohatec⁴ proposed a solution for gathering voter data on laptops with web cam, finger print scanner and signature pad to the army. Dohatec solution comprises of the electronic Voter Registration and ID software - 'eRegistry' and the higher level matching software – 'Biometrics Fusion Server' [Akan]. Microsoft examined the system and found it a robust solution and gave it worldwide focus. The Pilot Project went off successfully. Large scale matching solution has been provided since. Moreover many universities and organizations using biometric registrations and security systems all over the Bangladesh. For a democratic country public opinion is the most important determinant to establish a government and voting is the process through which people display their opinion and help to setup a democratic government. So the voting system should be reliable, accurate and it must be transparent. But the existing system has lot of limitations listed as below:

- a. The manual system that takes lots of time and the government has to bear the financial expenses for this purpose every election year.

- b. The election commission gets on pressure to prepare new and previous voter into the voter list. So it may contain numerous fake voters in voter list.
- c. Sometimes people ruin their votes by stamping on two or more signs mistakenly.
- d. While casting the votes the acting officers present in the centers marks a voter with a black ink on his or her nail but it is removable. So there is a chance for casting illegal votes.
- e. Manually checking voter list by polling agents takes long time whereas 100% vote cast is challenging.
- f. These votes are counted manually so the process becomes a gradual one which may be inaccurate as well.
- g. In Electronic voting machine has no reporting system whereas voter cannot understand his/her vote is casted or not.
- h. Anyone can press the button and give the vote. Device has no authentication process.

All these limitations together made people think about inventing a new system that will reduce corruption, increase accuracy and fast paced. The concept of electronic voting system comes from this necessity.

III. PROPOSED SYSTEM

In this system voter will select his/her preferable candidate by providing his/her opinion on a touch screen where all candidates' voting sign is displayed. Four layered network system is used for sending the votes from client to the main database, where there are three application server and a client are existed. Among them one application server works as dispatcher. The encrypted votes will be sent from the client to the dispatcher through an application server and this layer will send those votes to main database through another application server. The category "Biometric electronic voting" is potentially broad, referring to several distinct possible stages of electronic usage during the course of an election. The different phases of the proposed system are described below:

3.1 Registration

Here registration system has been proposed to be automated. Two different databases are used to make this system to be automated. One is NID database and another is voter database. People will be enlisted in the NID database. Voter database will contain only the people who are existing voters. The NID database people have to give their details and finger prints (who are equal to or over 18 years) to the authority.

¹ 31 May, 2016: bdnews24.

² 13 April, 2016: biometricupdate.com.

³ 4 April, 2016: Bangladesh Cabinet.

⁴ Dohatec CA is a trusted, qualified and licensed CA and issues Digital Certificates according to Bangladesh Law.

3.2 Candidate

Candidate is an important process in this system. A candidate can participate in the poll from a party or he can compete alone. On the polling session each candidate will have a sign on the touch pad where the voters give their opinion. The final result depends on the result of each candidate since the system has to keep an eye on the candidate's result of each area.

3.3 Checking

During registration when the fingerprint of the voters will be collected then a hash function will be generated for each finger print. Each voters detail will be laid under this hash function. When a vote will be cast the

system will read the packet with the hash function and will verify the constituents then the system will check whether the ID is blocked or not. If it is not blocked then the vote will be counted otherwise access denied.

3.4 Data Manipulation

All the data should be manipulated or updated to maintain good database management. When NID database will be updated then central database will be updated. The synchronization process depends on the database administrator and management. In that process all servers sync with central database and servers are always updated.

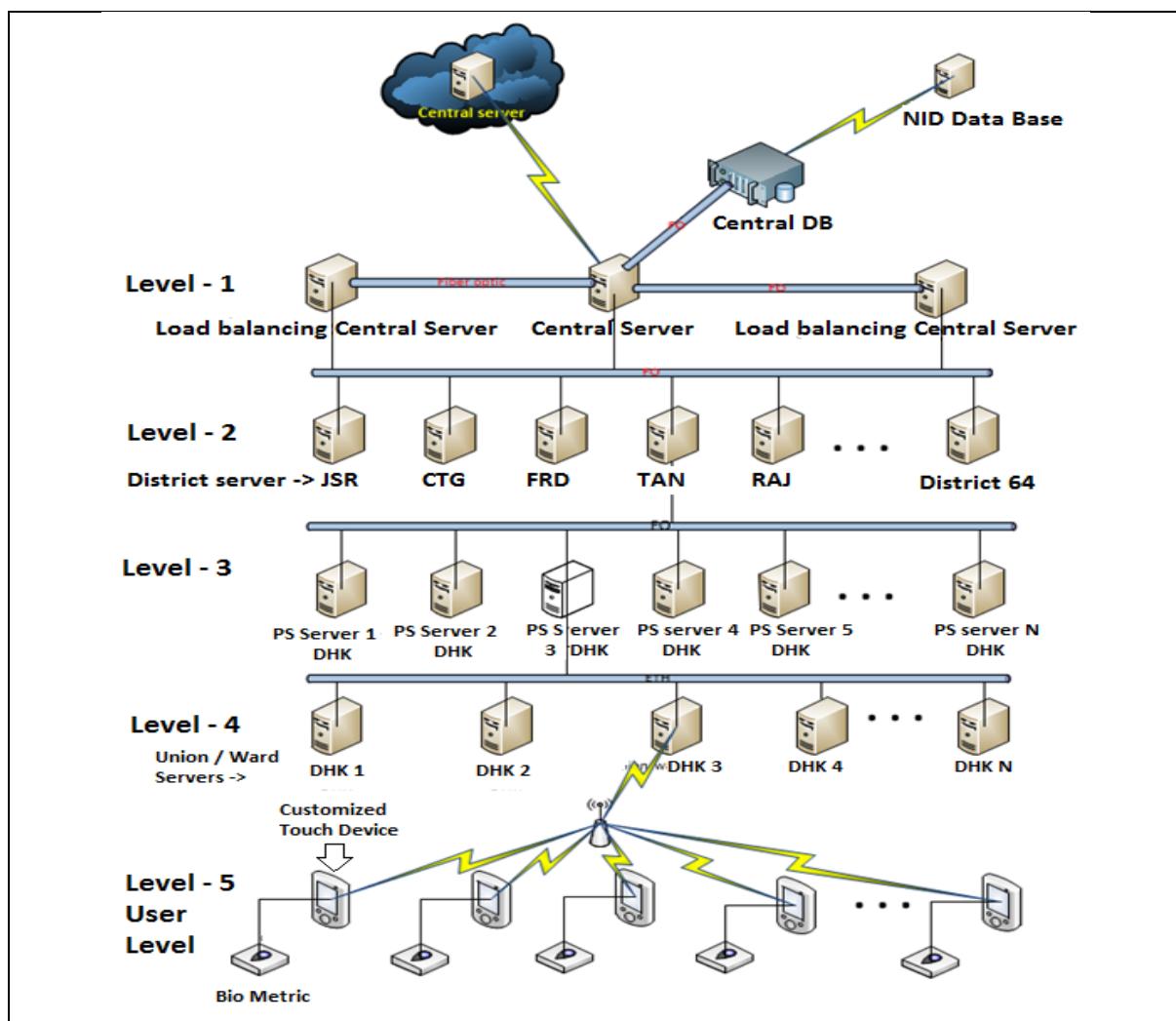


Fig.2: Four Layered Network for Proposed System

3.5 Accessibility

The election commission authority is not getting the supreme power to do whatever they want to do with the voter list or the voter details. They have the accessibility to the details but any kind of modifying or changing they will need the finger print of that voter.

3.6 Casting

The id of a voter will be blocked just after casting his/her

vote, he/she can vote again but it won't be counted. So it is ensured that only one process will be cast for a single voter. The voter will cast a vote by giving his/her identification with his/her finger print and vote on a touch screen.

3.7 Counting

The votes will be counted constitute wise. After finishing the voting session the votes stored constitute wise will be counted. Each constitute will pick only

the votes it won't think about the id. It will just pick the votes of each sign and then count them.

3.8 View Report

Report will show which candidate sign got how many votes from which constitute. Main database have the name of the candidates so the system will be able to publish the result for each candidate. From this result the system will also publish the final result that which sign win getting how many constitute. When voter cast his/her vote than he/she get one report successful report but this is not encourage because of time consuming and other resource (printers) is dependent. If anyone challenge the system is wrong than report will be generate with given charges.

IV. SYSTEM PERFORMANCES

Electronic voting system using fingerprint provides a high performance with high security to the voting system. The proposed system has covered the following areas:

4.1 Database Maintenance Efficiency

Database is mainly divided into two parts - Local NID database and Central Voter database. After entering all existing people in to the database, system will collect new entry from local NID database. Central database has two segments: Primary and Secondary database. Primary database keeps the record of that part of population. Moreover if anyone wants to change his/her information it is possible by using their

fingerprint. So there is no chance to make double entry. Primary database is used specially during the election period. When the election comes the people who are voter, their record upgrade from NID database to Central (Voter) database. At that time this database will distribute the voter list according to their area ID [Vishal, 2014].

4.2 Biometric Fingerprint maintenance system

Most efficient and effective part of this system is fingerprint, which is a unique identification for any voter. At the registration period when anyone gives his/her information, the system will generate an ID against that information. When any voter wants to cast his/her vote, the system will at first find his/her fingerprint at the database. Then the system will check whether the specific ID is block or unblock. When system find ID block it will reject that vote otherwise it will cast that vote and preserve that against that fingerprint [Akyildiz]. So the system will provide single vote for single person.

In the "Finger print scanner technology" the sensor has been optimally designed with SEIR (Surface Enhanced Irregular Reflection), incorporating high resolution and endurance (scratches, chemical corrosion, ESD, physical impacts). Its compact size and outstanding durability has made it one of the most advanced products in the world to successfully eliminate the optical defect of image distortion [Ravi, 2009].

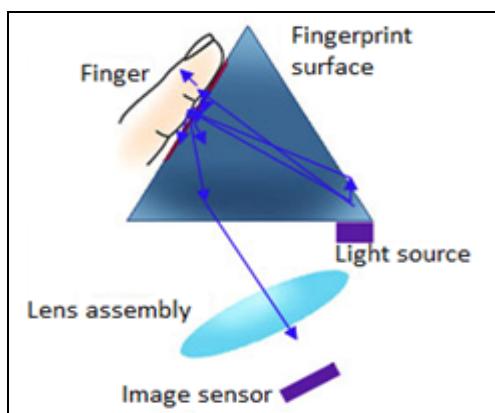


Fig.3: Finger print scanning

- Optimally designed with SEIR (Surface Enhanced Irregular Reflection)
- High resolution and endurance (scratches, Chemical corrosion, ESD, Physical, impacts).
- Superior optical design realizes small sized device without distortion, a defect of optical instruments.
- Patent registration number 79115, 341738.

4.3 Temporarily takes voter picture

When voter can press his/her finger in to the biometric device then system can automatically takes picture from voter. If any polling agent wants to give objection regarding any voter. Polling officer can easily generate report of specific voter.

4.4 Network Issues

A three tiered network system has been proposed here for implementation of this electronic voting system. There will be a number of clients in the most root level (Police Station level or sub-district level of a country). In the district level there will be a dedicated application server for those police station or sub-district clients

under that district. These clients together make a cluster. In the district level there will be some dispatchers. There will be a layer of application server layer after the dispatcher through which the dispatcher will pass the encrypted vote to the main database. The encrypted vote will be checked first to see whether the ID of the voter is locked or not [A. Fujioka, 1992]. The encrypted vote will be passed to that server and after that it will be directly passed to main database. Here from dispatcher to the main database, a fiber optic network will be used as the dispatcher has to handle millions of packets at a time, so it will need a better paced as well as secured network system [D.W & W.L, 1984]. At every layer the system

make some queues to back up data. This type of network structure will also preserve time.

V. SYSTEM ALGORITHM

The system proposed here for electronic voting has two active actors. One is the administrator and another one is the voter. The administrator has the supreme power to manipulate the voter details even the candidate details. The main responsibility of the administrator is to registration of the voters. Administrator is authorized to view the details of the candidate and also voters

although he is not authorized for modifying the details without the fingerprint of the voter or the candidate. An administrator is allowed to view all the reports like candidate result, area result or even political party result. He is also responsible for publishing the result. Voter is responsible for only casting the vote. If there comes any change in the voter details it is voter's responsibility to go to the authority and let them know so that the officials can modify the details taking the finger prints of that voter. An overview of the total system by use case diagram and flow chart is given below:

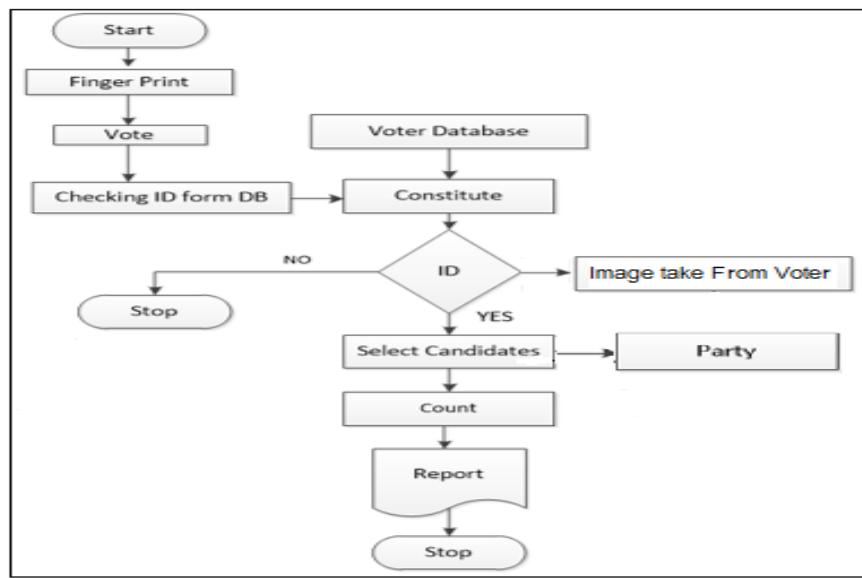


Fig.4: Use case diagram

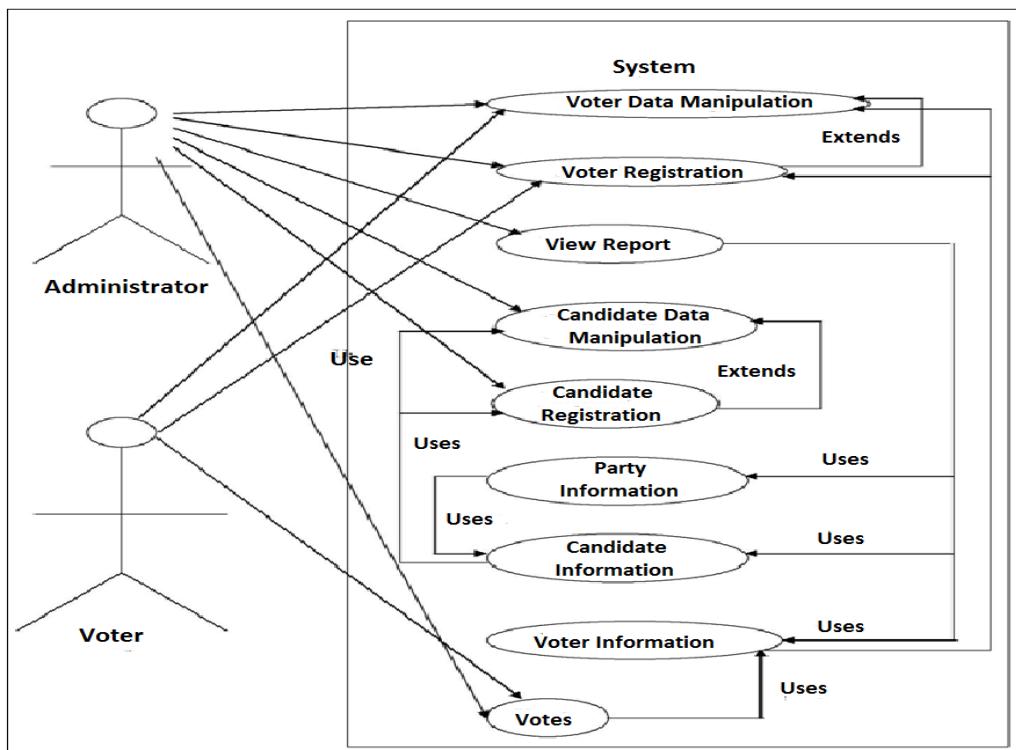


Fig.5: Voting process algorithm & system flowchart

VI. SIMULATION STUDY

A simulation model has been built in order to justify and examine the system performance, where it is useful for providing proper guidance on configuring the e-Voting system in terms of server requirements, configuring, networking, voting station and the like. The simulation

process includes a database system for voters and candidates with their personal information, authentication and locality of both. Valid casted votes are stored and invalid voters are rejected properly (Fig. 6, 7). This is obviously one of the main advantages of the proposed systems.

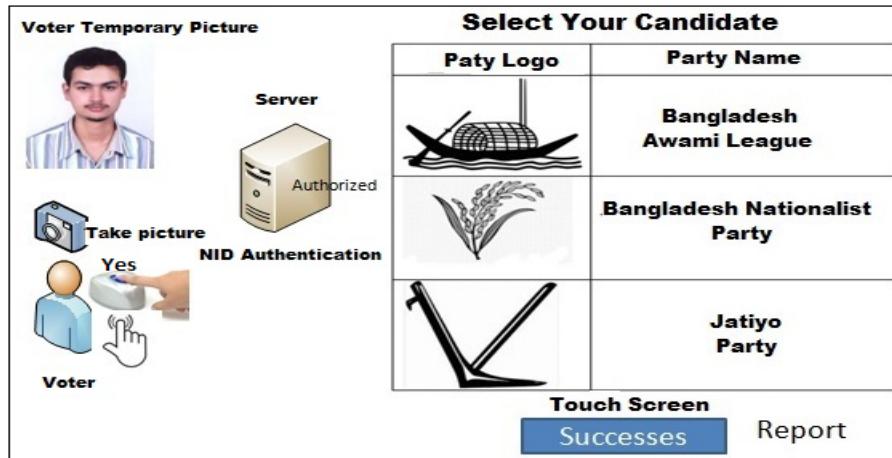


Fig.6: Voting process for valid voter

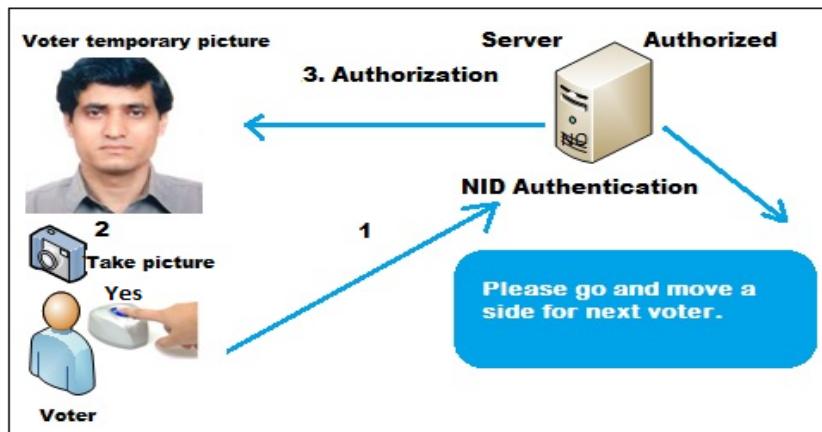


Fig.7: Voting process for invalid voter

Voters	Status
	Success
	Not authorized
	Success

Fig. 8: Voting dashboard

VII. CONCLUSION AND FUTURE WORKS

E-voting systems have many advantages over conventional systems but it still has to solve many hurdles before becoming coming to fruition [Rohan, 2015]. Bangladesh's majority population is rural and illiterate. Also there is shortage of power and inadequate network

between cities and villages. This system requires good bandwidth and high speed internet connection for operating, but it is still a distant reality in many rural areas. However conditions are improving with the onset of education in rural areas and with increasing urban population this project may soon become a reality. On the

other hand, biometric electronic voting system is very challenging work. Moreover, fingerprints have been one of the most highly used methods for human recognition; automated biometric systems have only been available in recent years. Because fingerprints have a generally broad acceptance with the general public, law enforcement and the forensic science community, they will continue to be used with many governments' legacy systems and will be utilized in new systems for evolving applications that require a reliable biometric. However, the proposed system is highly reliable and secure and is designed for more secure and transparent for every people. In the long run the maintenance cost is very less when compared to the present systems. The citizens can be sure that they alone can choose their leaders, thus exercising their right in the democracy. Though in this project we don't consider the outside voter of Bangladesh for security concern. Our further work include outside voter can join any local and national election.

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